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ABSTRACT

Taiwan has two technology teacher departments: one at the National Taiwan Normal University (NTNU) and the other at National Kaohsiung Normal University (NKNU). In recent years, both universities' technology teacher education programs have simultaneously followed two lines of development: the transition from an industrial arts education program to a technology education program and the pursuit of a diversified development. Materials relevant to technology education were reviewed and experts in the field of technology education were interviewed to identify program changes in technology teacher education in Taiwan. Among the conclusions of that research were the following: (1) although the pedagogical aims, structure, and content of the education programs at NTNU and NKNU are faced with diverse operational changes, training of technology teachers remains a main priority at both universities; (2) technology teacher training, technological training, and human resource development constitute the three main development trends for institutions providing technology teacher education in Taiwan; (3) clear differences exist in the direction and pace of development of technology teacher education at NTNU and NKNU; (4) both institutions have graduate programs; and (5) both departments are making special efforts to establish and increase cooperative relationships with business and industry. (Contains 10 references.) (MN)

Running head : TECHNOLOGY TEACHER EDUCATION PROGRAM CHANGES

Program Changes in Technology Teacher Education in Taiwan

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Paper presented at
the International Technology Education Association(ITEA)
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Abstract

In Taiwan, there are two technology teacher departments, at the National Taiwan Normal University (NTNU) and National Kaohsiung Normal University (NKNU) respectively. In recent years, the technology teacher preparation programs at these two universities have simultaneously followed two lines of development: (1) the transition from an industrial arts education program to one of technology education, and (2) the pursuit of a diversified development. In order to lead the two departments in the right direction towards achievement of these objectives, it has been necessary to make adjustments in the pedagogical aims, structure and content of their courses. The purpose of this paper is to discuss the causes of the changes in the technology teacher education programs, the nature of these changes and also future development trends. In addition, the paper will also contrast the main differences between the respective programs at NTNU and NKNU.

After a review of relevant materials, discussions with experts in the field and further analysis of all the information collected, the following conclusions were reached: (1)There are differences at every level concerning the factors that have influenced changes in the technology teacher education programs at the two universities. (2)The pedagogical aims, structure and content of the education programs at the two universities are faced with diverse operational changes. However, the training of technology teachers is still a main priority. (3)Technology teacher training, technological training and human resource development constitute the three main development trends for the future for institutions providing technology teacher education in Taiwan. (4) Regarding the outcome of the changes at the two universities in question, there are clear differences in the direction and pace of their development. (5)Both institutions have graduate programs, with NTNU preparing to introduce Ph.D. programs in the 1998 school year. (6) In order to provide better opportunities for its graduates, NTNU has implemented a system of capstone project course credits in its program of specialized required courses. (7)Both departments are making special efforts to establish and increase cooperative relationships with business and industry.

Key words: technology teacher education program, technology education

The Program Change of Technology Teacher Education in Taiwan

Introduction

The Republic of China on Taiwan (hereafter referred to as Taiwan) is located in the western Pacific Ocean off the southeast coast of mainland China, with Japan situated to the north and the Philippines to the south. In Taiwan there are two universities which have established specialized programs for the training of technology teachers. These universities are located in the cities of Taipei and Kaohsiung. Taipei, the capital of Taiwan, is situated in the northern part of the island, while Kaohsiung is an important seaport and center of international commerce in the south. The school in Taipei is called National Taiwan Normal University (hereafter referred to as NTNU), and the one in Kaohsiung is known as National Kaohsiung Normal University (hereafter referred to as NKNU). Both universities possess a Department of Industrial Technology Education (hereafter shortened to ITE). A look at Figure 1 will show how the respective locations of the two universities seem to provide a kind of balance in geographical terms.

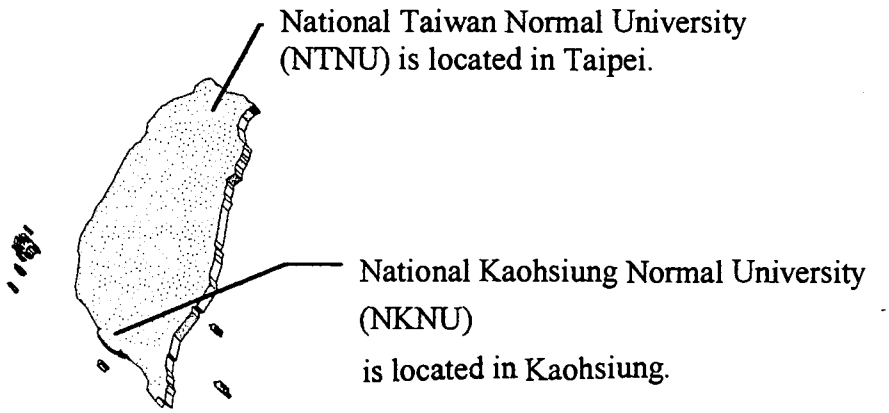

Figure 1: The location of NTNU and NKNU

The Department of Industrial Technology Education (ITE) of NTNU was first set up in February 1953 when the Industrial Arts Education Division of the Department of Industrial Education was established. In August 1972 the Division was renamed as the Industrial Arts Technology Division. In August 1982 the independent Department of Industrial Arts Education was formally established, specializing in the training of teachers of technical skills in high school education as well as conducting research and providing services related to industrial arts education. At this stage a "cluster" style of program structure was adopted. The Masters' program was begun in 1991, and in August 1994 the name was formally changed to its present one of the Department of Industrial Technological Education (ITE). Since 1995 undergraduate programs have been divided

between the Education Division and the Technology Division. On the Masters' program courses are divided into technological education and human resources, reflecting the new trend towards the teaching of living technology in the high school curriculum. In addition to the development of versatile teaching personnel, this department is also committed to the education of personnel for business fields. (NTNU-ITE, 1997). The Ministry of Education recently approved the establishment of a Ph.D. program at NTNU beginning from the 1998 school year, and applications are already being accepted. The Department of Industrial Technology Education at NKNU was established in 1969 but was renamed the Department of Industrial Education in August 1972. In 1980 an evening division was started to provide teachers of industrial arts and industrial technology with opportunities for professional improvement. This turned the Department into a center for further study and academic guidance for technology teachers in southern Taiwan. In 1989 the Department was renamed the Department of Industrial Arts Education again, and it began to play an active role in the redirection of technology education towards industrial arts education and to provide teachers of industrial arts in high schools and of related subjects at senior vocational schools with the opportunity to keep up with the latest trends in technology education. Another name change led to the Department being known as the Department of Technology Education, and in August 1994 two separate departments, namely the Department of Technology Education and the Graduate Institute of Industrial Arts Education, were combined to form the present Department of Industrial Technological Education. At the same time, undergraduate programs were divided between the Industrial Technology Education Division, the Manufacturing Technology Division and the Information Communications Division. On the Masters' program courses are divided into Technology Education, Educational Technology and Human Resource Development. Furthermore, the Department is currently increasing its efforts towards diversification in order to provide more opportunities for self-financing students. (NKNU-ITE, 1997)

Motivation and Purpose

Faculty in the Department of Industrial Technology Education at NTNU are currently involved in teaching and related services. They have a keen interest in the improvement and development of curriculum content for technology education programs in Taiwan. The main topics of research and discussion at the present time are concerned with curricula and teaching at the elementary and secondary school levels of basic education. There is also considerable interest in the content and development of specialized university-level training programs for technology teachers. Since there had been no previous thorough analysis of related research, the presenter strongly felt that this was a topic that deserved more attention and was thus prompted to engage in further research.

The main objectives of this paper are to provide an understanding of the reasons for

and the results of the changes in technology teacher education programs in Taiwan and to make a comparative analysis of the pedagogical aims and structure of courses at the two departments in question. In order to achieve these objectives, the following three questions must be raised: (1) What are the reasons for the necessary changes in technology teacher education programs at their current stage of development? (2) What forms do these changes take? (3) What differences exist between the aims, structure and content of the respective programs at the two universities that provide technology teacher training in Taiwan?

Methods and Procedures

In order to explore how the two departments have effected change in their aims and curricula, the methods used by the presenter include documentary analysis and interviews followed by comparative analysis. For Questions 1 and 2 the method was first to collect materials and conduct a preliminary collation and analysis. This was followed by discussion of the three questions in face-to-face and telephone interviews of four faculty members from the two departments to investigate the rationale, process, outcomes and trends of their program changes. Finally, a comparative analysis was made of the respective programs, including findings, conclusions and insights. This paper will provide technology teacher educators with two actual experiences related to changes in technology teacher education programs.

Major Factors Influencing Change in Technology Teacher Education in Taiwan

In recent years, the development of technology education in Taiwan has been affected in many ways, and the programs at the two departments providing technology teacher education have been faced with two major developments: (1) the transition from an industrial arts curriculum to one of technology education, and (2) a change in the pedagogic aims of the two departments, from the original one of training teachers of industrial arts and technology education to new aims of a diverse nature. The following four factors have influenced these two items of transition:

1. The Impact of Development Trends in Technology Education

   The curriculum for industrial arts education was based on the American model and formally introduced at the secondary school level in 1953. Since then, it has often followed changes in course trends in the United States. For example, the cluster concept of course curricula was adopted in the 1980s. It can be said that the process of development of technology education in Taiwan has followed the American experience. Lately the trend has been towards the transformation of industrial arts education into technology education. Since the US started in this direction, many countries, Taiwan included, have followed suit in introducing curriculum reform. Indeed, the transition

from industrial arts to living technology (LT) programs is already tried and tested in Taiwan.

2. The Influence of Changing Standards in Secondary School Industrial Arts Education

In Taiwan, what were previously termed industrial arts (IA) courses have been renamed as living technology (LT) programs. The curriculum standards for each school level are determined and promulgated by the Ministry of Education (MOE), and each school's curriculum is planned and the authorized textbooks are edited on the basis of the curriculum standard. From Table 1 it can be ascertained that the number of industrial arts courses has greatly decreased. As a result, teaching content needs to be greatly simplified. With only half the time previously devoted to industrial arts teaching at their disposal, technology teachers are faced with the considerable challenge of teaching a wide range of technical skills and subjects. Therefore, for institutions that train technology teachers, providing appropriate programs that enable students to acquire the basic skills required by living technology teachers is one of the most important objectives at the present time.

Table 1.

A Brief Summary of the Technology Education Programs Prescribed by IA and LT Curriculum Standards

	Course Title and Synopsis	
Level	IA Curriculum Standard	LT Curriculum Standard
Junior High (Grades 7 -9)	-All students are required to select "Industrial Arts" (IA) or "Home Economics" (HE), but schools commonly assign boys to IA programs. -IA consists of 2 hrs/wk or about 216 hrs in 3 years. -IA consists of 13 domains.	-All students are required to take "Home Economics & Living Technology" (HE&LT), 2 hrs/wk. -LT in HE&LT consists of 1 hr/wk or about 108 hrs in 3 years. -LT includes 4 domains.
Senior High (Grades 10 -12)	-All students in grades 10 and 11 are required to take IA or HE, but schools commonly assign boys to IA programs. -2 hrs/wk or about 144 hrs in 2 years (i.e., grades 10 and 11). -IA consists of 5 domains.	-All students in grades 10 and 11 are required to take HE&LT, 2 hrs/wk. -LT in HE&LT consists of 1 hr/wk or about 72 hrs in 2 years. -LT includes 4 domains, the same as those in junior-high-school LT.

(Modified from Lee, 1996)

As noted in Table 1, for the new LT, the present total number of classroom hours in IA will be cut in half. In addition, a comparison of the content domain of IA and that of LT indicates that LT will lead to a change in content domain (see Table 2). (Lee, 1996) If we look at the course contents, we can see how LT has become a combined curriculum, unlike the previous IA curriculum, which was divided into many separate subjects. With this change, technology teacher education programs will have to make large-scale alterations if they are to enable students to acquire the necessary teaching skills.

Table 2.
A Comparison of the Content Domain of IA and that of LT

	Content Domain	
Level	Industrial Arts	Living Technology
Junior High	1. Introduction to industrial arts	1. Technology and life
	2. Blueprint reading and planning	2. Information and communication
	3. Ceramics	3. Construction and manufacturing
	4. Woodworking	4. Energy and transportation
	5. Plastics	
	6. Metalworking	
	7. Electricity	
	8. Graphics Communication	
	9. Construction and Life	
	10. Manufacturing industry	
	11. Information industry	
	12. Audio-visual communication	
	13. Energy and power	
Senior High	1. Project planning and drafting	1. Technology and life
	2. Industrial materials	2. Information and communication
	3. Power and energy	3. Construction and manufacturing
	4. Information industry	4. Energy and transportation
	5. Automation	

3. Implementation of the Open Policy of Secondary School Teacher Training

For many years, ITE graduates from NKNU and NTNU were almost always able to take up positions as teachers of industrial arts/living technology at the middle-school level. However, since the MOE introduced its new policy towards elementary and secondary school teacher training programs in 1994, this guarantee of immediate employment has been virtually eliminated. The implementation of this policy has had a significant impact on institutions that provide technology teacher education. The teacher preparation system in Taiwan is changing. Under the "Teacher Preparation Law," revised in 1994, all public and private universities which have approved colleges, departments, graduate institutes and/or programs specializing in education may participate in teacher training. That is to

say, with the removal of the guarantee of immediate employment, graduates from the specialized technology teacher education programs must compete with many other qualified graduates for the opportunities available in the gradually more crowded market for technology education. Therefore, students have started to feel the pressure of possible unemployment after graduation, and this pressure naturally extends to the schools that provide technology teacher education.

Regarding the roles of instructors at the two universities in question, since other institutions may now provide technology teacher training programs, they have had to make rapid adjustments in their original curriculum structures, on the one hand to continue to be able to attract students, and also to improve the competitive abilities of their graduates in the job market.

4. Review and Discussion of Problems in the IA Curriculum by Faculty Members

After discussion and analysis, the Curriculum Development Board of the Department of Technology Education at NTNU summarized four main problems facing traditional IA programs. (Tsai, 1997)

(1) The technology field is a complicated one: the IA curriculum covers five specialized skill areas, i.e. electronics and electrical engineering, mechanical technology, design, woodworking, graphic communications etc. There is no way to focus on main points, and teaching resources and facilities are spread around and used inefficiently.

(2) Curriculum planning is insufficiently specialized: on-site training takes up more than half of class hours, and although it can enhance students' practical skills, the downside is that opportunities for advanced theoretical training are lost, and a thorough, well-rounded program is not a possibility.

(3) Cross-linking is poor within the curriculum: the links between required courses, advanced electives and general electives are not properly planned. As a result, courses are disorganized and it is not possible to make full use of the functions of both basic and advanced courses.

(4) Pedagogical aims are not sufficiently clear: the increase in the number of technical fields, added to the lack of depth of the courses provided, has led to the majority of students having no clear idea of the direction of their future development. This in turn lowers morale and motivation.

In confronting these problems, all the teachers of the Department have made strenuous efforts over the past five years in collecting information, conducting research, soliciting the opinions of other experts and attending departmental meetings and outside conferences. There has been ongoing research into the direction of future reforms, and the amendments in structure and content of future curricula have already been determined.

In addition, besides examining the courses students take, the faculty have not

concerned themselves solely with the requirements of technology education teachers. They must also enable students to be aware of development trends in other areas of employment. That is, a program must have clear goals for the development of its students, and any curricula reform should be inline with these goals (Lee, 1997). Many teachers hope that a comprehensive plan can be made to handle the problems described above.

Findings and Discussions

1. Curriculum reform is a gradual process, and overall reform comes about through integral reform. (See Figur 2.)

On the whole, development and reform of the programs at the two universities that provide technology teacher education programs in Taiwan can be categorized into four stages: a) introduction of the IA curriculum b) adoption of the cluster curriculum c) the transition to technological education programs, and d) the multi-directional curriculum. The change from an IA curriculum to one of technology education has been brought about by a process of gradual improvement of its separate components that has resulted in a general reform. The system went from a traditional IA curriculum, through a cluster curriculum, to a comprehensive and complete reform of industrial technology education programs.

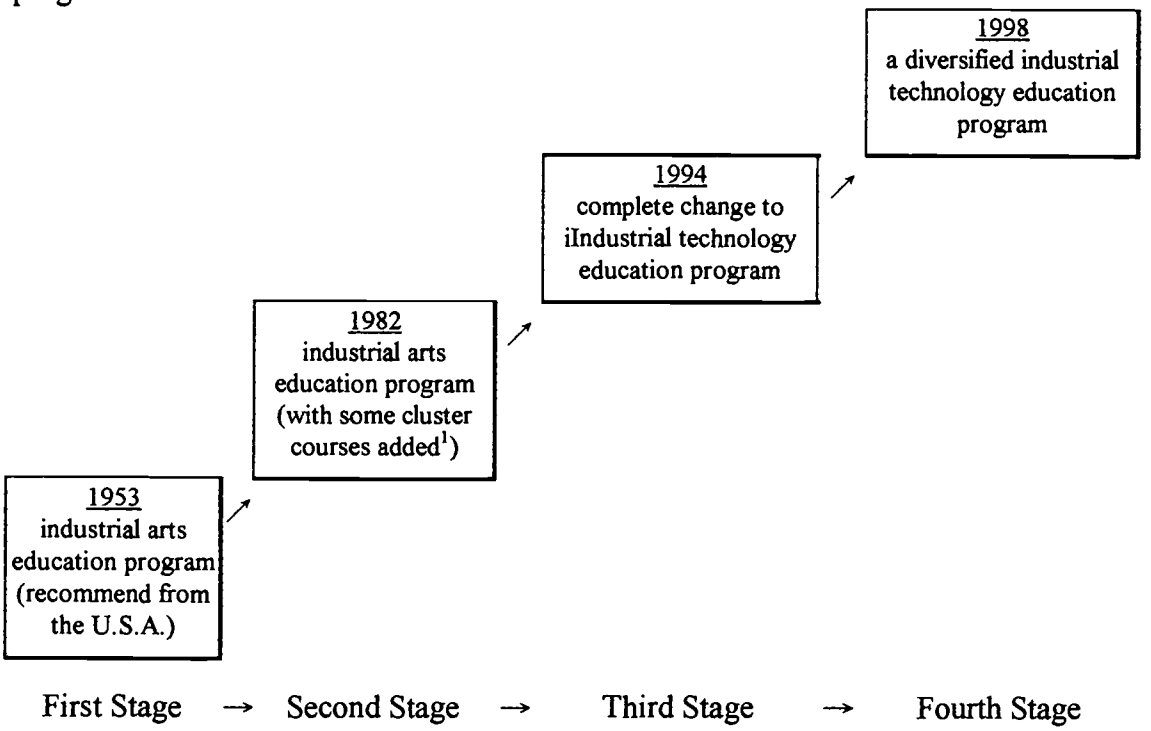

Figure 2. Changes in the Technology Teacher Education Program in Taiwan

[1] These cluster courses include information technology and computing, power and energy, construction and manufacturing, graphic communications etc.

2. Differences in important influencing factors at different stages of development

Of the factors affecting technology teacher education programs in Taiwan, the teachers interviewed recognized that the main factors before 1994 were "the impact of development trends in technology education" and "changing standards in secondary school IA and technology programs." Around 1994, despite the existence of the four influencing factors, the greatest impact came from the "implementation of the open policy of secondary school teacher training." Some of the interviewees felt that their technology teacher education programs were in a life-or-death situation at that time due to the fact that any school which applied for and received approval could train elementary and secondary school teachers. In addition, tuition fees that had previously been paid out of public funds were now being paid by students. These factors had either a direct or indirect effect in weakening the competitive ability of the two departments.

3. How these impacts can prove to be useful

It can be understood from the above that the short term effect of the transition from the old IA curriculum to the new one of technology education was on the one hand the gradual disappearance of IA education and on the other hand the fact that all universities could apply to establish teacher training programs and take a slice of the technology education pie. Small wonder, then, that IA education in Taiwan was said to be in a state of crisis. Actually, IA education in the United States had also gone through a similar crisis. As Wright pointed out in 1981, American IA education effected a thorough process of reform in the face of the critical impact of social change. In Chinese, the word for "crisis" is formed by combining two characters which respectively mean "danger" and "opportunity." This shows that a crisis, like a change, is a two-sided coin (see Figure 3). (Lee, 1991, p.220)

危 pronounced *wei* ↗
DANGER

機 pronounced *ji*
OPPORTUNITY

Figure 3. Crisis means "danger" together with "opportunity."

Certainly, in the case of the abovementioned factors of influence pointed out by academic experts, on the surface there are specific elements of danger at different levels, but actually these influences also provide great motivation for assessing an old program and developing a new one out of it. For example, an open policy towards teacher training

lessens opportunities for "regular" LT teachers and there is less room for the development of new teacher training centers. In order to overcome this crisis, the course of action must be carefully thought out, and channels for further development must be actively sought. Only in this way can there be change for the better.

4. The pedagogical aims of teacher training institutions have already become diversified.

The two universities that provide technology teacher education in Taiwan have, in recent years, actively tried to give teachers a general understanding of the ways in which this development crisis can be handled. One way has been the setting up of a Curriculum Development Board. The Board has been involved in extensive research, discussion with experts, and organization of and participation in numerous international conferences. The aim of the current program changes is best expressed by the slogan "Success is permissible, failure is not." As Lee (1991 p.221) has mentioned, it is important to avoid the "superficial and non-substantial" outcome of some IA program reforms, which merely adopted a name change with no real reform of content taking place. With their misplaced concern for outward appearances, such changes often do more harm than good.

Table 3 demonstrates the fact that the pedagogic aims of the two departments are not confined to producing secondary school technology teachers. The ITE Department at NKNU also trains skilled personnel for business fields, while the corresponding Department at NTNU trains personnel in the areas of computer applications and human resource development (HRD).

Table 3.

A Comparison of the Pedagogic Aims of the two Departments

Pedagogic Aims	
ITE NKNU	ITE NTNU
■training LT teachers	■training LT teachers
■training qualified personnel for social organization of technology, IT and IA	■training qualified personnel in computer program design, network management, communication media designer and creator, teaching media maker
	■training high school technology teachers in the filed of information
	■training the qualified personnel of HRD training, planning and management

5. Changes have also taken place in the advanced curriculum

These two departments have primarily aimed at the training of secondary school pre-service and in-service industrial arts/living technology teachers and currently offer undergraduate and Masters' degree programs. The ITE Department at NTNU will add Ph.D. programs and two-year curriculum management programs for institutes of technology from August 1998.

Table 4.

A Comparison of Program Levels in the Two Departments

	Programs Levels
ITE NKNU	■undergraduate → graduate -master
ITE NTNU	■undergraduate → graduate -master ···〉 Ph.D.* ■two-year college(HRD)**

*,** These program will implement in August 1998.

6. Specialized required core courses in the two departments have many similarities and a few minor differences.

In order to become qualified industrial arts teachers, undergraduate students in the two departments have to satisfactorily complete a four-year on-campus course of study and a one year secondary school-based internship. During their four years on campus, students receive a tuition-waiver and partial living expenses.

The pre-service teacher preparation curriculum has three principal components: General/liberal coursework, technical/specialty coursework ,and Pedagogical/professional coursework. Although a minimum of 30 credits of designated technical coursework and a minimum of 20 credits of specified pedagogical coursework are mandated in the current secondary school teacher certification requirements, teacher preparation programs commonly offer their students more than the minimal requirements. For instance, the minimum credit number for graduation for undergraduate students in both Departments of Industrial Technology Education is 148-28 credits in required general coursework, 26 credits in required pedagogical coursework, 47 or 66 credits in required technical coursework from the above three components. (See Table 5. and Table 6.)

Table 5.

A Comparison on Two Departments' Undergraduate program frame

Credits	ITE NKNU	ITE NTNU
Minimum credit number for graduation	148	148
General/liberal coursework required credits	28/(20+8)	28/(20+8)
Pedagogical/professional coursework required credits	26	26
Technical/specialty coursework required credits[2]	66	47
Professional division required credits	—	15[3]
Elective credits (professional division)	—	8-24[4]
(common)	38[5]	24-16

[2] These credits contain more than 30 credits required to be a living technology teacher

[3]These professional division required credits are distributed as follows:

(1) HRD division -15 credits,(2)computer application division -15 credits

[4]These elective credits contains HRD field and computer application professional field courses,.

[5]These elective credits consist of:

(1)Common- industrial technology field -10 credits

(2)Information and communication division field - 8 credits or production and manufacturing division field -18 credits.

Table 6.

A Comparison on Two Departments' Undergraduate Core-required programs

ITE NKNU	ITE NTNU
History of Technology(2)	—
Introduction to Industrial Technology Education(2)	Introduction to Industrial Technology Education(2)
—	*Information Technology(2)*
Communication Technology(**3**)	Communication Technology(**2**)
Transportation(**3**)	Transportation Technology(**2**)
Construction (2)	Construction Technology(2)
Manufacturing Technology(**3**)	Manufacturing Technology(**2**)
Graphics *Science*(4)	Graphics (4)
Mechanical Technology(4)	Mechanical Technology(4)
Woodworking Technology(4)	Woodworking Technology(4)
Electronic Communication(4)	Electronic Communication(4)
Graphic Communications(2)	Graphic Communications(2)
Planning & Management of Technology Education Laboratories(2)	(contained in pedagogical/professional coursework)
Electrical Work(2)	Electrical Technology(2)
Energy & Power(**4**)	Energy & Power(**2**)
Introduction to Computers(3)	Introduction to Computers(3)
Basic Design(4)	Basic Design(4)
Calculus(**6**)	Calculus(**4**)
—	*Capstone Project (2)*
Problems in Industrial Education or *Topics of Industrial Technical(4)*	—
General Physics(4)	—
General Chemistry(4)	—
66/148	49/148

7.Future multi-directional development will require careful management.

The two departments in question are facing the prospect of the development of multi-directional aims. As Lee (1997) said: With the introduction of multi-directional reform, the specialized nature of technology teacher education has come under attack. After implementation of the open policy on teacher training, and with the number of secondary school LT teachers reaching saturation levels, institutions providing technology teacher education have been forced into multi-directional operations. The outcome is the division of resources and the undermining of specialized teaching of technology education, research and related services. For this reason, future changes in curriculum development must be carried out with caution.

Conclusions

The presenter has drawn the following conclusions:

1. There are differences at every level concerning the factors that have influenced changes in the technology teacher education programs at the two universities which provide technology teacher training in Taiwan. The main factors include: (1) the impact of development trends in technology education, (2) the influence of changing standards in IA/technology education, (3) the open policy towards the training of elementary and secondary school teachers, and (4) the results of research conducted by faculty on the problems of IA curricula. These factors have resulted in different effects at different stages of development.
2. The pedagogic aims, course structure and course contents at the two universities have already come face-to-face with the changing trend towards diversified operations. Since other universities and colleges received approval for the preparation of elementary and secondary school teachers in 1995, these two departments have begun to broaden their aims and extend the scope of their programs. However, training technology teachers remains their first priority.
3. Technology teacher training, technological training and human resource development are the three main development trends for the future for institutions providing technology teacher education in Taiwan. Besides maintaining training programs for secondary school IA and technology teachers, future objectives include the training of skilled technical and managerial personnel for business fields.
4. Regarding the outcome of the changes at the two universities in question, although there are great similarities in their specialized technology teacher education programs, there are also clear differences in the direction and pace of their development.
5. Both schools have graduate programs. NTNU is set to introduce Ph.D. programs and two-year curriculum management programs for institutes of technology.
6. In order to provide more opportunities for graduates, NTNU has introduced a system of capstone project to its specialized required core courses.
7. Both departments are making special efforts to establish and increase cooperative relationships with business and industry.

To sum up, in the next century changes in the technology teacher education programs at the two Normal Universities in Taiwan will continue to focus on the technology teacher education curriculum, but attention must also be given to the curricula for specialized technology and human resource personnel training programs. As to the outcome, only time will provide the answers.

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I would like to thank the 60th Annual Conference of the International Technology Education Association (ITEA) for giving me the chance to present this paper. This is the first time in my life that I have presented a paper in English. It's a great honor and I am not likely to ever forget this visit to Fort Worth, Texas, U.S.A.

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